UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Ex parte MADHAV DATTA, DAVE EMORY, SUBHASH M. JOSHI, SUSANNE MENEZES, and DOOWON SUH

Appeal No. 2006-1193
Application No. 09/961,036

ON BRIEF

Before THOMAS, JERRY SMITH, and LEVY, Administrative Patent Judges.

JERRY SMITH, Administrative Patent Judge.

DECISION ON APPEAL

This is a decision on the appeal under 35 U.S.C. § 134 from the examiner's rejection of claims 17-19, 21, 23, and 25.

The disclosed invention pertains to a dual-stack, ball-limiting metallurgy and method of making same.

Representative claim 17 is reproduced as follows:

17. A process comprising:

- forming a metallization;
- forming a refractory metal first layer over the metallization;
- forming a refractory metal second layer over the refractory metal first layer;
- forming a refractory metal third layer above and on the refractory metal second layer, wherein the refractory metal third layer is substantially the same metal as the refractory metal first layer;
- forming a refractory metal fourth layer above and on the refractory metal third layer, wherein the refractory metal fourth layer is substantially the same metal as the refractory metal second layer; and
- forming an electrically connective bump above the refractory metal fourth layer.

The examiner relies on the following references:

Agarwala	U.S. Pat. 5,376,584	Dec, 27, 1994
Yi et al. ("Yi")	U.S. Pat. 6,348,730	Feb. 19, 2002, filed Aug. 3, 2000

Tummala, et al., eds., "Microelectronics Packaging Handbook, Semiconductor Packaging, Part II," 2nd edition, Kluwer Academic Publishers, Boston, 1997, pp. 132-139 ("Tummala Handbook").

The following rejections are on appeal before us:

1. Claims 17, 19, 21, 23, and 25 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Agarwala in view of Yi [answer, page 3].

2. Claim 18 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Agarwala in view of Yi, and further in view of the Tummala Handbook [answer, page 4].

Rather than repeat the arguments of appellants or the examiner, we make reference to the brief and the answer for the respective details thereof.

OPINION

We have carefully considered the subject matter on appeal, the rejections advanced by the examiner and the evidence of obviousness relied upon by the examiner as support for the rejections. We have, likewise, reviewed and taken into consideration, in reaching our decision, the appellants' arguments set forth in the brief along with the examiner's rationale in support of the rejections and arguments in rebuttal set forth in the examiner's answer.

It is our view, after consideration of the record before us, that the evidence relied upon by the examiner does support the examiner's rejection of claims 17-19, 21, 23, and 25. Accordingly, we affirm.

In rejecting claims under 35 U.S.C. § 103, it is incumbent upon the examiner to establish a factual basis to support the legal conclusion of obviousness. See In re Fine, 837 F.2d 1071, 1073, 5 USPQ2d 1596, 1598 (Fed. Cir. 1988). In so doing, the examiner is expected to make the factual determinations set forth in Graham v. John Deere Co., 383 U.S. 1, 17, 148 USPQ 459, 467 (1966). The examiner must articulate reasons for the examiner's decision. In re Lee, 277 F.3d 1338, 1342, 61 USPQ2d 1430, 1434 (Fed. Cir. 2002). In particular, the examiner must show that there is a teaching, motivation, or suggestion of a motivation to combine references relied on as evidence of obviousness. Id. at 1343. The examiner cannot simply reach conclusions based on the examiner's own understanding or experience - or on his or her assessment of what would be basic knowledge or common sense. Rather, the examiner must point to some concrete evidence in the record in support of these findings." In re Zurko, 258 F.3d 1379, 1386, 59 USPQ2d 1693, 1697 (Fed. Cir. 2001). Thus the examiner

must not only assure that the requisite findings are made, based on evidence of record, but must also explain the reasoning by which the findings are deemed to support the examiner's conclusion. However, a suggestion, teaching, or motivation to combine the relevant prior art teachings does not have to be found explicitly in the prior art, as the teaching, motivation, or suggestion may be implicit from the prior art as a whole, rather than expressly stated in the references. The test for an implicit showing is what the combined teachings, knowledge of one of ordinary skill in the art, and the nature of the problem to be solved as a whole would have suggested to those of ordinary skill in the art. In re Kahn, 441 F.3d 977, 987, 78 USPQ2d 1329, 1336 (Fed. Cir. 2006) citing In re Kotzab, 217 F.3d 1365, 1370, 55 USPQ2d 1313 (Fed. Cir. 2000). See also In re Thrift, 298 F. 3d 1357, 1363, 63 USPQ2d 2002, 2008 (Fed. Cir. 2002). These showings by the examiner are an essential part of complying with the burden of presenting a prima facie case of obviousness. Note In re Oetiker, 977 F.2d 1443, 1445, 24 USPQ2d 1443, 1444 (Fed. Cir. 1992). If that burden is met, the burden then shifts to the applicant to overcome the prima facie case with argument and/or evidence. Obviousness is then

determined on the basis of the evidence as a whole and the relative persuasiveness of the arguments. See Id.; In re Hedges, 783 F.2d 1038, 1039, 228 USPQ 685, 686 (Fed. Cir. 1986); In re Piasecki, 745 F.2d 1468, 1472, 223 USPQ 785, 788 (Fed. Cir. 1984); and In re Rinehart, 531 F.2d 1048, 1052, 189 USPQ 143, 147 (CCPA 1976). Only those arguments actually made by appellants have been considered in this decision. Arguments which appellants could have made but chose not to make in the briefs have not been considered and are deemed to be waived. See 37 C.F.R. §41.37(c)(1)(vii) (2004).

We first consider the examiner's rejection of claims 17, 19, 21, 23, and 25 under 35 U.S.C. § 103(a) as being unpatentable over Agarwala in view of Yi [answer, page 3]. Since appellants' arguments with respect to this rejection have treated these claims as a single group which stand or fall together, we will consider independent claim 17 as the representative claim for this rejection.

Appellants argue that the examiner has failed to establish a *prima facie* case of obviousness because the cited Agarwala and Yi references do not teach the claimed arrangement of metal layers [brief, page 10].

Appellants note that Yi teaches copper in connection with chromium and argue that the limitations of claim 17 that require [four] refractory metal layers are not taught or suggested by Yi [*id.*]. Appellants further argue that Agarwala adds nothing to remedy this deficiency [*id.*]. Appellants conclude that claim 17 is unobvious over Yi in view of Agarwala because the specific limitations recited in claim 17 are not taught by the cited references, and also because the cited references taken as a whole do not suggest the claimed subject matter [brief, pages 11 and 12].

The examiner responds that appellants' arguments are premised upon the following two incorrect assumptions [answer, page 5]:

(1) that one of ordinary skill would not use the particular refractory metals disclosed by Agarwala [col. 4, lines 3-14] in the phased metal layer because Yi uses copper with chromium metals in the phased metal layer [answer, pages 5 and 6], and,

(2) that Yi does not teach the first and third metals layers are substantially the same metal, and also that the second and fourth metal layers are substantially the same metal, as claimed [answer, page 6].

The examiner addresses both assumptions, stating with respect to point (1), that appellants correctly point out that Yi uses chromium (Cr) and copper (Cu) in the phased metal layer [answer, page 6]. The examiner agrees that copper is not a refractory metal [*id.*]. The examiner asserts that appellants' argument is irrelevant because Agarwala discloses a phased metal layer of two refractory metals, as described in the paragraph bridging columns 3 and 4 [answer, page 6, see also Agarwala, column 3, lines 62-68, cont'd col. 4, lines 1-14, emphasis added]. The examiner asserts that all of the metals of Agarwala's non-wettable layer 22 are refractory and all of the metals of Agarwala's wettable metal layer 26 (with the exception of copper) are refractory [answer, page 6; see also Agarwala at col. 3, lines 62-68, cont'd col. 4, lines 1-14]. The examiner notes that Agarwala, when combined with Yi, is not limited to a Cr-Cu (Chromium-Copper) phased metal layer [answer, page 6]. The examiner further points out that appellants disclose and claim as "refractory" several of the same metals disclosed in Agarwala, specifically, Ni, Co, Pd, Pt, Ti, Cr, Mo, and Zr (see instant claim 19) [answer, page 7, ¶1]. Thus, the examiner concludes that Agarwala clearly discloses the use of two refractory metals in phased metal layer 24 [*id.*]. The examiner asserts that appellants' argument ignores the fact that Agarwala discloses a phased metal layer 24 of two refractory metals [*id.*, emphasis added].

The examiner further notes that Yi was applied to (1), show what one of ordinary skill knows a phased metal layer to be, and (2), to show an especially beneficial manner of making a phased metal layer since Agarwala does not disclose in detail what a phased metal layer is or how it is manufactured [*id.*].

In particular, with respect to appellants' assumption (2), *supra*, the examiner notes that nothing in claim 17 requires the recited first, second, third, and fourth metal layers to be different metals [*id.*, emphasis added]. The examiner further notes that instant claim 17 recites only "forming a refractory metal first layer over the metallization," and similarly, "forming a refractory metal second layer over the refractory metal first layer" [answer, page 8, emphasis added]. Therefore, the examiner concludes that any metal layer over the metallization of the semiconductor chip in Yi qualifies as the first metal layer, and any metal layer over the first metal layer qualifies as the second metal layer with respect to claim 17 [answer, page 8, emphasis added]. The examiner further asserts that Yi's nominal labels of "first," "second, "third," and "fourth" metal layers should not be interpreted as literally corresponding to the recited "first," "second, "third," and "fourth" metal layers of instant claim 17 [*id.*].

"During patent examination, the pending claims must be given their broadest reasonable interpretation consistent with the specification." In re Hyatt, 211 F.3d 1367, 1372, 54 USPQ2d 1664, 1667 (Fed. Cir. 2000). The broadest reasonable interpretation of the claims must also be consistent with the interpretation that those skilled in the art would reach. In re Cortright, 165 F.3d 1353, 1358, 49 USPQ2d 1464, 1467 (Fed. Cir. 1999). The words of the claim must be given their plain meaning unless applicant has provided a clear definition in the specification. "When an applicant states the meaning that claim terms are intended to have, the claims should be examined with that meaning, in order to achieve a complete exploration of the applicant's invention and its relation to the prior art." In re Zletz, 893 F.2d 319, 321, 13 USPQ2d 1320, 1322 (Fed. Cir. 1989).

With respect to the scope of the claimed "refractory metal," we note that various extrinsic sources vary widely in their definitions, e.g., ranging broadly from a "material resistant to high temperatures" [Webster's II, New Riverside Dictionary, Riverside Publishing Co., 1984] to specific groups of metals with high melting points. However, we note that the Court of Appeals for the Federal Circuit has determined that extrinsic evidence is

unlikely to result in a reliable interpretation of patent claim scope unless considered in the context of the intrinsic evidence. Phillips v. AWH Corp., 415 F.3d 1303, 1319, 75 USPQ2d 1321, 1331 (Fed. Cir. 2005) (en banc). In particular, with respect to the use of dictionaries, the court in Phillips stated: "different dictionaries may contain somewhat different sets of definitions for the same words. A claim should not rise or fall based upon the preferences of a particular dictionary editor, or the court's independent decision, uninformed by the specification, to rely on one dictionary rather than another." Phillips, 415 F.3d at 1322, 75 USPQ2d at 1333. The court in Phillips reaffirmed its view that the specification "is always highly relevant to the claim construction analysis. Usually, it is dispositive; it is the single best guide to the meaning of a disputed term." Phillips, 415 F.3d at 1315, 75 USPQ2d at 1327, quoting Vitronics Corp. v. Conceptronic, Inc., 90 F.3d 1576, 1582, 39 USPQ2d 1573, 1577 (Fed. Cir. 1996). Accordingly, we will look to the instant specification for the intended meaning of the claimed "refractory metal."

In particular, we note that appellants have provided within the instant specification specific examples of refractory metals suitable for instant metal first layer 26 that include: titanium, zirconium, hafnium, nickel, cobalt,

palladium, platinum, chromium, molybdenum, and tungsten [instant specification, page 4, lines 21-23, cont'd page 5, lines 1-3, emphasis added]. Therefore, we agree with the examiner that Agarwala discloses the use of refractory metals (as defined by appellants), in both non-wettable layer 22 and wettable layer 26. See Agarwala at col. 4, lines 3-11:

> **The non-wettable layer 22 may be, for example, chromium (Cr), titanium (Ti), Zirconium (Zr), molybdenum (Mo), tantalum (Ta), or any other metal or alloy which will adhere to the surface of the supporting substrate 20 or semiconductor chip (not shown). The wettable layer 26 may be, for example, copper (Cu), cobalt (Co), nickel (Ni), platinum (Pt), palladium (Pd), or any other metal or alloy which is wettable by molten solder. Phased layer 24 is a transition layer between non-wettable layer 22 and wettable layer 26 and is comprised of a phased combination of the two metals making up the layers 22 and 26.**

For example, we note that Agarwala's disclosure explicitly supports the use of chromium in non-wettable layer 22 and platinum in wettable layer 26 [see col. 4, lines 3-11]. We further note that both chromium and platinum are listed as examples of refractory metals within the instant specification [instant specification, page 4, lines 21-23, cont'd page 5, lines 1-3]. Therefore, we agree with the examiner that Agarwala teaches the use of two refractory metals in phased metal layer 24, noting that Agarwala explicitly discloses: "[p]hased layer 24 is a transition layer between not-wettable layer 22 and wettable layer 26 and is comprised of a phased combination of the two metals making up the layers 22 and 26" [col. 4, lines 11-14, emphasis added].

Patentability is based upon the claims. "It is the claims that measure the invention." SRI Int'l v. Matsushita Elec. Corp., 775 F.2d 1107, 1121, 227 USPQ 577, 585 (Fed. Cir. 1985) (en banc). When making a patentability determination, the claimed invention must be compared to the prior art [emphasis added]. We agree with the examiner that Yi's nominal labels of "first," "second, "third," and "fourth" metal layers [col. 3, lines 6-13] should not be interpreted as literally corresponding to the recited "first," "second, "third," and "fourth" metal layers of instant claim 17. We note that it is the claim that must be read upon the reference, and not the other way around.

Specifically, we agree with the examiner that nothing in claim 17 requires the recited first, second, third, and fourth metal layers to be different metals [emphasis added]. We note that Agarwala teaches a non-wettable layer 22 that corresponds to the instant claimed metallization [col., 3, lines 66 and 67; see also Fig. 6]. Upon modifying Agarwala with Yi's teachings of phased layer 53 [as shown in Fig. 9], as suggested by the examiner, we find that Yi's chrome (i.e., chromium) layer 51 corresponds to the instant claimed "refractory metal first layer over the metallization" [Yi, Fig. 9; see also claim 17]. We further find that the first three of the eight

individual chrome layers shown as comprising metal 151 [Yi, Fig. 9, col. 4, line 37] meet the requirements of the second, third, and fourth refractory metal layers recited in claim 17, noting that the combination teaches all refractory layers 1-4 being made of chromium. We therefore agree with the examiner that all the limitations of representative claim 17 are suggested by the combination of Agarwala and Yi.

With respect to the motivation to modify Agarwala with the teachings of Yi, we do not agree with appellants' assertion that the examiner has impermissibly relied upon hindsight in making the combination [brief, page 12, ¶1]. In particular, we note that the Agarwala reference fails to provide specific details of the phased layer and that Yi makes up for this deficiency [see e.g., Yi at col. 4, lines 32-49]. We further find that the examiner has provided a proper motivation to combine the teachings of Agarwala with the teachings of Yi that is taken directly from the Yi reference [answer, page 4; see also Yi, col. 2, lines 61-67, emphasis added]. Accordingly, we shall sustain the examiner's rejection of claims 17, 19, 21, 23, and 25.

We next consider the examiner's rejection of claim 18 under 35 U.S.C. § 103(a) as being unpatentable over Agarwala in view of Yi, and further in view of the Tummala Handbook [answer, page 4].

As pointed out by the examiner [answer, page 11], appellants merely state that the previously argued deficiencies of Agarwala and Yi are incorporated by reference with respect to dependent claim 18 [brief, page 14]. Appellants further note that the cited Tummala Handbook illustrates a no-bond pad metallization (i.e., the 2.3 micron Al-4% Cu) that is in direct contact with a Cr layer [brief, page 14]. We note that appellants have failed to explain precisely how the limitations of claim 18 distinguish over the Tummala Handbook disclosure relied upon by the examiner.

We note that the cited Tummala Handbook explicitly discloses: "[a]s many as four to six levels of wiring have been created on the chip," this clearly teaching the recited "metal-one (M1) to M6" layers that provide the electrical interconnections within the chip package [page 133, ¶2, emphasis added]. We further note that the Tummala Handbook explicitly discloses a 1.4 micron Al-4% Cu bond pad that attaches to (i.e., contacts) a third 2.3 micron Al-4% Cu metallization layer, as shown in Fig. 8.2 [page 133]. We also note that the examiner has provided additional evidence that it is notoriously well known for the bonding pad to be copper [answer, page 5; see also Tummala Handbook, p. 137, last paragraph, and Fig. 8-6 on page 138]. Because we have fully addressed the alleged deficiencies of Agarwala

and Yi with respect to representative claim 17, *supra*, and because appellants have failed to point out exactly how the limitations of claim 18 distinguish over the combination of references relied upon by the examiner, we will sustain the examiner's rejection of claim 18 for the same reasons set forth by the examiner in the rejection.

In summary, we have sustained the examiner's rejection of all claims under appeal. Therefore, the decision of the examiner rejecting claims 17-19, 21, 23, and 25 is affirmed.

No time period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. § 1.136(a)(1)(iv).

AFFIRMED.

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